Popular Electronics®

WORLD'S LARGEST-SELLING ELECTRONICS MAGAZINE OCTOBER 1980/95¢

For Motorists: A Road-Icing Alert

For Computerists: Alarm/Control Clock

For Experimenters: Accurate In-Circuit Ohms Tests

Electronic Games for 1981

From Talking Dolls to Hand-held Games to Video Games, New Electronic Technology is Changing the Face of Leisure Fun & Education.

WILLIAM C CLEMENCE 10
7 CLEMENCE AV 9DC
STERLING MA 01564
450864 CEM 0007C094 14ID NOV82

0 14024 14278 10

Flash: Carl Warren Reveals Details on Radio Shack's New 6809-CPU Communication Computer

Computer Bits

By Carl Warren

Low-Cost Machine Spells Communication

THE system about which there have been rumors for months has finally been announced. Dubbed the TRS-80 Videotex, Radio Shack's latest marvel is based on the Motorola 6809 microprocessor, has a built-in modem, and incorporates the MC6847 video display generator along with 16K bytes of internal RAM memory. What makes the $399 machine exciting are its many features, which include:

- The unit exhibits color graphics generated by the Motorola MC6847 VDG IC. This chip permits a picture element display (pixel) of 256 × 192 in 8 colors. The alphanumeric display is 32 characters by 16 lines. This character display is a function of the characteristics of the video generator IC and of a standard television set. The standard TV has a bandwidth of about 3 to 4 MHz and, consequently, inhibits the number of characters that can be displayed with clarity. However, the MC6847 takes this into account and displays a 5 × 7 font character in an 8 × 12 box.
- Videotex takes advantage of the two most powerful data processing and communication devices you own: your television receiver and telephone. The unit plugs into both with, at most, the help of a screwdriver.
- Videotex has a built-in keyboard and is small enough to fit into a standard-size attaché case.
- The unit is easy to use since the assumption was made that the buyer would not necessarily be inclined to learn how to program a computer.
- Videotex is more than a machine. It implies a complete communication philosophy. This communication feature is enhanced by an agreement between Compuserve (see "Computer Bits," PE June) and Radio Shack for a low-cost timesharing system. To fully support the communication concept for Videotex and the total TRS-80 line of computers, Radio Shack is offering a communication package that includes: required protocol software, Compuserve password and one hour of free time. All of this is priced at $29.95 and is available from any Radio Shack store.

Radio Shack's TRS-80 Videotex displays color graphics.

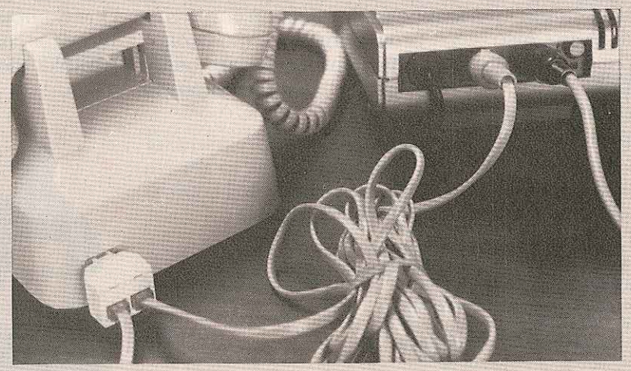
Although Radio Shack mainly markets its own, and supporting, products, it is also planning to offer the communication software for the Apple, Atari and PET microcomputers. The purpose of this is to provide maximum support for the age of electronic mail.

Further enhancing the communication concept, Radio Shack will be offering a 16-channel multiplexer for the company's Model II. This, according to Charles Philips, senior vice president of USA operations, will permit companies to set up their own communication systems. The multiplexer will allow up to 16 calls at a time and the Model II has the functional ability to store and forward messages. This, tied into the use of Videotex, will make it easier for field personnel to communicate vital information to their home offices, asserts Philips.

Videotex is available now in limited quantities, but by the first quarter of 1981, it is expected to be available in all Radio Shack stores.

The Compuserve connection is of vital importance to the success of the Videotex concept. The Compuserve people currently market the Micronet system and, as mentioned last month, began altering the system so that it would be more "people" oriented. According to Compuserve's director of corporate communication, John Meier, in order to fully support the color graphics functions of Videotex, they are developing very special user software and some exciting surprises. Some of the latter include the AP news wire service and full news from more than 10 newspapers nationwide.

More Printers. Both Okidata and Epson have printers that should interest personal computerists. Although

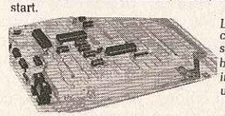

The Videotex can be plugged easily into your television receiver and telephone.

Start learning and computing for only $129.95 with a Netronics 8085-based computer kit. Then expand it in low-cost steps to a business/development system with 64k or more RAM, 8" floppy disk drives, hard disks and multi-terminal I/O.

THE NEW EXPLORER/85 SYSTEM

Special! *Full 8" floppy, 64k system for less than the price of a mini! Only* **$1499.95!**

Imagine — for only $129.95 you can own the starting level of Explorer/85, a computer that's expandable into full business/development capabilities — a computer that can be your beginner system, an OEM controller, or an IBM-formatted 8" disk small business system. From the first day you own Explorer/85, you begin computing on a significant level, and applying principles discussed in leading computer magazines. Explorer/85 features the advanced Intel 8085 cpu, which is 100% compatible with the older 8080A. It offers onboard S-100 bus expansion, Microsoft BASIC in ROM, plus instant conversion to mass storage disk memory with standard IBM-formatted 8" disks. All for only $129.95, plus the cost of power supply, keyboard/terminal and RF modulator if you don't have them (see our remarkable prices below for these and other accessories). With a Hex Keypad/display front panel, Level "A" can be programmed with no need for a terminal, ideal for a controller, OEM, or a real low-cost start.


Level "A" is a complete operating system, perfect for beginners, hobbyists, industrial controller use. $129.95

LEVEL "A" SPECIFICATIONS

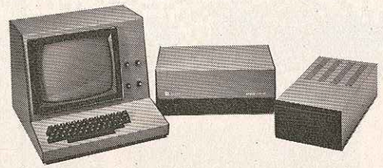
Explorer/85's Level "A" system features the advanced Intel 8085 cpu, an 8355 ROM with 2k deluxe monitor/operating system, and an advanced 8155 RAM I/O . . . all on a single motherboard with room for RAM/ROM/PROM/EPROM and S-100 expansion, plus generous prototyping space.

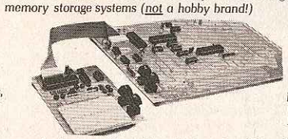
PC Board: Glass epoxy, plated through holes with solder mask. • **I/O:** Provisions for 25-pin (DB25) connector for terminal serial I/O, which can also support a paper tape reader . . . cassette tape recorder input and output . . . cassette tape control output . . . LED output indicator on SOD (serial output) line . . . printer interface (less drivers) . . . total of four 8-bit plus one 6-bit I/O ports. • **Crystal Frequency:** 6.144 MHz. • **Control Switches:** Reset and user (RST 7.5) interrupt . . . additional provisions for RST 5.5, 6.5 and TRAP interrupts onboard. • **Counter/Timer:** Programmable, 14-bit binary. • **System RAM:** 256 bytes located at F800, ideal for smaller systems and for use as an isolated stack area in expanded systems . . . RAM expandable to 64K via S-100 bus or 4k on motherboard.

System Monitor (Terminal Version): 2k bytes of deluxe system monitor ROM located at F000, leaving 0000 free for user RAM/ROM. Features include tape load with labeling . . . examine/change contents of memory . . . insert data . . . warm start . . . examine and change all registers . . . single step with register display at each break point, a debugging/training feature . . . go to execution address . . . move blocks of memory from one location to another . . . fill blocks of memory with a constant . . . display blocks of memory . . . automatic baud rate selection to 9600 baud . . . variable display line length control (1-255 characters/line) . . . channelized I/O monitor routine with 8-bit parallel output for high-speed printer . . . serial console in and console out channel so that monitor can communicate with I/O ports.

System Monitor (Hex Keypad/Display Version): Tape load with labeling . . . tape dump with labeling . . . examine/change contents of memory . . . insert data . . . warm start . . . examine and change all registers . . . single step with register display at each break point . . . go to execution address. Level "A" in this version makes a perfect controller for industrial applications, and is programmed using the Netronics Hex Keypad/Display. It is low cost, perfect for beginners.

(Also available wired & tested, $1799.95)


Full 8" disk system for less than the price of a mini (shown with Netronics Explorer/85 computer and new terminal). System features floppy drive from Control Data Corp., world's largest maker of memory storage systems (not a hobby brand!)


Level "A" With Hex Keypad/Display.

HEX KEYPAD/DISPLAY SPECIFICATIONS

Calculator type keypad with 24 system-defined and 16 user-defined keys. Six digit calculator-type display, that displays full address plus data as well as register and status information.

LEVEL "B" SPECIFICATIONS

Level "B" provides the S-100 signals plus buffers/drivers to support up to six S-100 bus boards, and includes: address decoding for onboard 4k RAM expansion selectable in 4k blocks . . . address decoding for onboard 8k EPROM expansion selectable in 8k blocks . . . address and data bus drivers for onboard expansion . . . wait state generator (jumper selectable), to allow the use of slower memories . . . two separate 5 volt regulators.

LEVEL "C" SPECIFICATIONS

Level "C" expands Explorer/85's motherboard with a card cage, allowing you to plug up to six S-100 cards directly into the motherboard. Both cage and card are neatly contained inside Explorer's deluxe steel cabinet. Level "C" includes a sheet metal superstructure, a 5-card, gold plated S-100 extension PC board that plugs into the motherboard. Just add required number of S-100 connectors.

Explorer/85 With Level "C" Card Cage.

LEVEL "D" SPECIFICATIONS

Level "D" provides 4k of RAM, power supply regulation, filtering decoupling components and sockets to expand your Explorer/85 memory to 4k (plus the original 256 bytes located in the 8155A). The static RAM can be located anywhere from 0000 to EFFF in 4k blocks.

LEVEL "E" SPECIFICATIONS

Level "E" adds sockets for 8k of EPROM to use the popular Intel 2716 or the TI 2516. It includes all sockets, power supply regulator, heat sink, filtering and decoupling components. Sockets may also be used for 2k x 8 RAM IC's (allowing for up to 12k of onboard RAM).

DISK DRIVE SPECIFICATIONS

- 8" CONTROL DATA CORP. professional drive.
- LSI controller.
- Write protect.
- Single or double density.
- Data capacity: 401,016 bytes (SD), 802,032 bytes (DD), unformatted.
- Access time: 25ms (one track).

DISK CONTROLLER/ I/O BOARD SPECIFICATIONS

- Controls up to four 8" drives.
- 1771A LSI (SD) floppy disk controller.
- Onboard data separator (IBM compatible).
- 2 Serial I/O ports
- Autoboot to disk system when system reset.
- 2716 PROM socket included for use in custom applications.
- Onboard crystal controlled.
- Onboard I/O baud rate generators to 9600 baud.
- Double-sided PC board (glass epoxy.)

DISK DRIVE CABINET/POWER SUPPLY

- Deluxe steel cabinet with individual power supply for maximum reliability and stability.

ORDER A COORDINATED EXPLORER/85 APPLICATIONS PAK!

Beginner's Pak (Save $26.00!) — Buy Level "A" (Terminal Version) with Monitor Source Listing and AP-1 5-amp Power Supply: (regular price $199.95), now at SPECIAL PRICE: **$169.95** plus post. & insur.

Experimenter's Pak II (Save $53.40!) — Buy Level "A" (Hex Keypad/Display Version) with Hex Keypad/Display, Intel 8085 User Manual, Level "A" Hex Monitor Source Listing, and AP-1 5-amp Power Supply: (regular price $279.35), all at SPECIAL PRICE: **$219.95** plus post. & insur.

Special Microsoft BASIC Pak (Save $103.00!) — Includes Level "A" (Terminal Version), Level "B", Level "D" (4k RAM), Level "E", 8k Microsoft in ROM, Intel 8085 User Manual, Level "A" Monitor Source Listing, and AP-1 5-amp Power Supply: (regular price $439.70), now yours at SPECIAL PRICE: **$329.95** plus post. & insur.

ADD A TERMINAL WITH CABINET, GET A FREE RF MODULATOR: Save over $114 at this SPECIAL PRICE: **$499.95** plus post. & insur.

Special 8" Disk Edition Explorer/85 (Save over $104!) — Includes disk-version Level "A", Level "B", two S-100 connectors and brackets, disk controller, 64k RAM, AP-1 5-amp power supply, Explorer/85 deluxe steel cabinet, cabinet fan, 8" SD/DD disk drive from famous CONTROL DATA CORP. (not a hobby brand!), drive cabinet with power supply, and drive cable set-up for two drives. This package includes everything but terminal and printers (see coupon for them). Regular price $1630.30, all yours in kit at SPECIAL PRICE: **$1499.95** plus post. & insur. Wired and tested, only **$1799.95.**

Special! Complete Business Software Pak (Save $625.00!) — Includes CP/M 2.0, Microsoft BASIC, General Ledger, Accounts Receivable, Accounts Payable, Payroll Package: (regular price $1325), yours now at SPECIAL PRICE: **$699.95.**

Please send the items checked below:

- ☐ **Explorer/85 Level "A" kit** (Terminal Version) . . . **$129.95** plus $3 post. & insur.
- ☐ **Explorer/85 Level "A" kit** (Hex Keypad/Display Version) . . . **$129.95** plus $3 post. & insur.
- ☐ **8k Microsoft BASIC** on cassette tape. **$64.95** postpaid.
- ☐ **8k Microsoft BASIC in ROM kit** (requires Levels "B", "D" and "E") . . . **$99.95** plus $2 post. & insur.
- ☐ **Level "B" (S-100) kit** . . . **$49.95** plus $2 post. & insur.
- ☐ **Level "C" (S-100 6-card expander) kit** . . . **$39.95** plus $2 post. & insur.
- ☐ **Level "D" (4k RAM) kit** . . . **$69.95** plus $2 post. & insur.
- ☐ **Level "E" (EPROM/ROM) kit** . . . **$5.95** plus 50¢ p&h.
- ☐ **Deluxe Steel Cabinet** for Explorer/85 . . . **$49.95** plus $3 post. & insur.
  - ☐ Fan For Cabinet . . . **$15.00** plus $1.50 post. & insur.
- ☐ **ASCII Keyboard/Computer Terminal kit:** features a full 128 character set, u&l case; full cursor control; 75 ohm video output; convertible to baudot output; selectable baud rate, RS232-C or 20 ma. I/O, 32 or 64 character by 16 line formats, and can be used with either a CRT monitor or a TV set (if you have an RF modulator) . . . **$149.95** plus $3.00 post. & insur.
  - ☐ **DeLuxe Steel Cabinet** for ASCII keyboard/terminal . . . **$19.95** plus $2.50 post. & insur.
- ☐ **New! Terminal/Monitor:** (See photo) Same features as above, except 12" monitor with keyboard and terminal is in deluxe single cabinet: kit . . . **$399.95** plus $7 post. & insur.
- ☐ **Hazeltine terminals:** Our prices too low to quote — **CALL US**
- ☐ **Lear-Sigler terminals/printers:** Our prices too low to quote: **CALL US**
- ☐ **Hex Keypad/Display kit** . . . **$69.95** plus $2 post. & insur.
- ☐ **AP-1 Power Supply Kit** ±8V @ 5 amps) in deluxe steel cabinet . . . **$39.95** plus $2 post. & insur.
- ☐ **Gold Plated S-100 Bus Connectors** . . . **$4.85** each. postpaid.
- ☐ **RF Modulator kit** (allows you to use your TV set as a monitor) . . . $8.95 **postpaid.**
- ☐ **16k RAM kit** (S-100 board expands to 64k) . . . **$199.95** plus $2 post. & insur.
- ☐ **32k RAM kit** . . . **$299.95** plus $2 post. & insur.
- ☐ **48k RAM kit** . . . **$399.95** plus $2 post. & insur.
- ☐ **64k RAM kit** . . . **$499.95** plus $2 post. & insur.
- ☐ **16k RAM Expansion kit** (to expand any of the above in 16k blocks up to 64k) . . . **$99.95** plus $2 post. & insur. each.
- ☐ **Intel 8085 cpu Users' Manual** . . . **$7.50** postpaid.
- ☐ **12" Video Monitor** (10MHz bandwidth) . . . **$139.95** plus $5 post. & insur.
- ☐ **Beginner's Pak** (see above) **$169.95** plus $4 post. & insur.
- ☐ **Experimenter's Pak** (see above) . . . **$219.95** plus $6 post. & insur.
- ☐ **Special Microsoft BASIC Pak Without Terminal** (see above) . . . **$329.95** plus $7 post. & insur.
- ☐ Same as above, plus **ASCII Keyboard Terminal With Cabinet, Get Free RF Modulator** (see above) . . . **$499.95** plus $10 post. & insur.
- ☐ **Special 8" Disk Edition Explorer/85** (see above) . . . **$1499.95** plus $26 post. & insur.
  - ☐ **Wired & Tested** . . . **$1799.95** plus $26 post. & insur.
- ☐ **Extra 8" CDC Floppy Drives** . . . **$499.95** plus $12 post. & insur.
  - ☐ **Cabinet & Power Supply For Drive** . . . **$69.95** plus $3 post. & insur.
- ☐ **Drive Cable Set-up For Two Drives** . . . **$25** plus $1.50 post. & insur.
- ☐ **Disk Controller Board With I/O Ports** . . . **$199.95** plus $2 post. & insur.
- ☐ **Special: Complete Business Software Pak** (see above) . . . **$699.96** postpaid.
  SOLD SEPARATELY:
  - ☐ **CP/M 1.4** . . . **$100** postpaid.
  - ☐ **CP/M 2.0** . . . **$150** postpaid.
  - ☐ **Microsoft BASIC** . . . **$325** postpaid.
- ☐ **Intel 8085 cpu User Manual** . . . $7.50 **postpaid.**
- ☐ **Level "A" Monitor Source Listing** . . . **$25** postpaid.

Continental U.S.A. Credit Card Buyers Outside Connecticut

CALL TOLL FREE: 800-243-7428

To Order From Connecticut Or For Technical Assistance, call (203) 354-9375

Total Enclosed (Conn res. add sales tax) $ _____

Paid By:

☐ Personal Check ☐ Cashier's Check/Money Order

☐ **VISA** ☐ **Master Charge** (Bank No. — — — —)

Acct. No. _____ Exp. Date _____

Signature _____

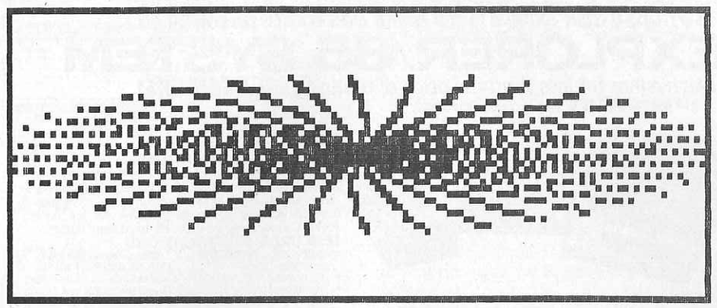
Print Name _____

Address _____

City _____

State _____ Zip _____

NETRONICS Research & Development Ltd.
333 Litchfield Road, New Milford, CT 06776



```
900 REM *** SPIRAL PATTERN ***  DEMO PROGRAM
1000 CLEAR 1000
1010 L=0:M=0:N=0
1020 KEY=0:K=10
1030 Q=0:R=0
1040 CLS
1041 A$=""
1050 FF$="WELLCOME TO THE OKIDATA BOOTH."
1060 GG$=" "
1070 HH$="OKIDATA EXHIBITS **
     MICRO LINE PRINTER FAMILY **"
1080 II$="** SPIRAL PATTERN **"
1090 JJ$="X=M*R*COS(Q)+64"
1100 KK$="Y=N*R*SIN(Q)+24"
1110 LL$="Q=L*3.14/180"
1120 MM$="* M *  IS AMP OF  * X * "
1130 NN$="* N *  IS AMP OF  * Y * "
1140 PP$="* L *  IS STEP IN DEGREE. "
2100 PRINT FF$
2110 PRINT GG$
2120 PRINT HH$
2130 PRINT GG$
2140 INPUT "PLS KEY IN (1) ONLY KEY= "↑KEY
2150 IF KEY=1 THEN GOTO 2170
2160 GOTO 2140
2170 CLS
3200 PRINT II$
3210 PRINT JJ$
3220 PRINT KK$
3230 PRINT LL$
3240 PRINT GG$
3250 PRINT MM$
3260 PRINT NN$
3270 PRINT PP$
3280 PRINT GG$
3290 '
3300 INPUT "PLS KEY IN * M= "↑M
3310 PRINT GG$
3320 INPUT "PLS KEY IN * N= "↑N
3330 PRINT GG$
3340 INPUT "PLS KEY IN * L= "↑L
3350 GOSUB 4000
3360 Q=L*3.14/180
3370 X=M*R*COS(Q)+64
3380 Y=N*R+SIN(Q)+24
3390 '
3400 IF X)127   THEN GOTO 3500
3410 IF X(0     THEN GOTO 3500
3420 IF Y)47    THEN GOTO 3500
3430 IF Y(0     THEN GOTO 3500
3440 '
3450 SET(X,Y)
3460 R=R+0.1
3470 L=L+K
3480 '
3490 GOTO 3360
3500 LPRINT FF$: LPRINT GG$:
     LPRINT HH$: LPRINT GG$
3510 LPRINT II$
3520 LPRINT GG$
3530 LPRINT JJ$
3540 LPRINT KK$
3550 LPRINT LL$
3560 LPRINT GG$: LPRINT GG$: LPRINT GG$:
     LPRINT GG$: LPRINT GG$
3570 GOSUB 5000
3580 FOR LC=1 TO 5
3590 LPRINT GG$
3600 NEXT
3601 LPRINT "THIS GRAPHIC PATTERN WAS PRINTED
     ON A MICROLINE 80 PRINTER CONNECTED TO A
     TRS-80 PERSONAL COMPUTER WITHOUT EXPAN
     SION INTERFACE. USE RADIO SHACK
     CABLE 26-1411."
3605 FOR LC=1 TO 10
3606 LPRINT GG$
3607 NEXT
3610 GOTO1000
4000 REM *OUTER FRAME **
4010 CLS
4020 A=0:B=0
4030 FOR X=0 TO 127
4040 SET(X,0)
4050 NEXT X
4060 FOR Y=0 TO 47
4070 SET(127,Y)
4080 NEXT
4090 FOR A=0 TO 127
4100 X=127-A
4110 SET(X,47)
4120 NEXT
4130 FOR B=0 TO 47
4140 Y=47-B
4150 SET(0,Y)
4160 NEXT
4170 RETURN
5000 FOR J=0 TO 15 : A$=""
5010 FOR I=0 TO 63
5020 A$=A$+CHR$(PEEK(15360+I+(64*J))):
     NEXT I : LPRINT A$:NEXT J
5030 RETURN
```

Okidata's Microline 80 printer can print graphics such as the above. The software, also shown, is straightforward and requires no special routines.

they are not letter-quality printers, they are good for first-draft material.

Okidata's printers, which are fairly new, include the Microline 80 for $800. This model is designed specifically to work with units like the TRS-80 and can print graphics, as illustrated. Notice that the software (for the TRS-80) is straightforward and requires no special routines to accommodate the printer.

Okidata also offers mid-range printers that feature better print quality, bidirectional printing and forms control. The Microline 82 is priced at $895 and is an 80-column unit, while the Microline 83 at $1195 is a 136-column unit. The latter can handle forms as wide as 15 inches, and operates at 120 char/s. All three units print condensed, double width, and enhanced characters as well as graphics characters.

The Epson Model TX-80 dot-matrix printer interfaces directly to a TRS-80.

As an enhancement to the Microline 80, Asent Computer Services has developed a $74.95 set of software products for the Apple computer. This software is extremely powerful and dumps every point on the Hi-Res Apple screen. If you want to get an idea of how powerful this software is, send a self-addressed, stamped envelope to Tim Dysert, National Sales Manager, Asent Computer Services, and ask for a Microline 80 dump of Donald Duck.

Offering similar features as the Microline 80 is the Epson Model TX-80 dot-matrix printer, priced at $799. This printer has PET-type graphics and is designed to interface directly to a TRS-80. However, for an additional $55, you can obtain the serial interface, which allows you to use either RS-232C or 20-mA current loop.

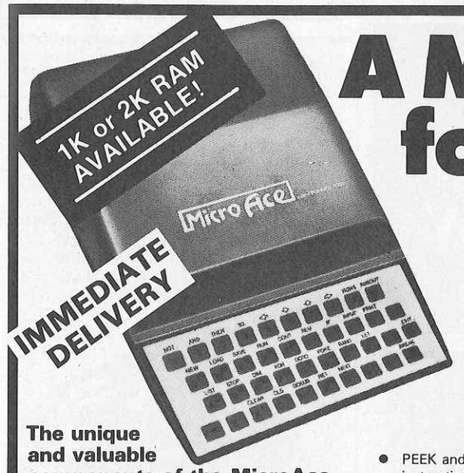
Should you want to use the TX-80 with a Heath/Zenith H-89, you will need the serial interface, configured in the following manner. First, mount the unit in the printer box, as shown in the manual. Next, set the word length to 8 bits rather than the factory-set 7 bits. Disable parity and enable serial data entry by cutting the jumper marked JNOR. (There is an error in the documentation at this point, so in most cases this jumper will need to be cut.) Also, solder in a jumper at JREV; this will set the reverse channel = MARK, and TTY-TXD = SPACE. This last jumper is important since it makes the interface compatible with Heath software. You will also find that it is necessary to put together a connection cable with male DB-25 connectors on both ends to allow for proper system connection.

Those of you that have or plan to buy an Apple computer will require the Apple interface for the TX-80. This unit is priced at $99. The card is designed to sit in the first slot of the Apple motherboard and can handle the correct electrical and software protocols with no modifications.

The TX-80 is a strong, consistent printer and, according to Epson's marketing manager, Chris Rutowski, PET owners are finding the unit a flexible and excellent addition to their systems.

Want to Ring Your Chimes? If you are not familiar with Epson as a printer company, you probably have heard of its melody ICs. The latest 7910 series offers renditions of "Greensleeves," "Home On The Range," and "Mary Had a Little Lamb." It can also operate as a door chime or a beeping alarm.

The board, which includes the melody chip, but without battery or speaker, costs $14. The little unit is great for that special music box you



Licenced by Sinclair Research Ltd.

A Microcomputer for everyone at a Micro Price

The MicroAce - a new generation of miniature computers

A COMPLETE COMPUTER for $149.00 for 1K Kit

Post and Packing FREE

(Add 6% Tax for Shipments inside California)

The unique and valuable components of the MicroAce

The MicroAce is not just another personal computer. Quite apart from its exceptionally low price, the MicroAce has two uniquely advanced components: the powerful BASIC interpreter, and the simple teach yourself BASIC manual.

The unique versatile BASIC interpreter offers remarkable programming advantages:

- **Unique 'one-touch' key word entry: the MicroAce eliminates a great deal of tiresome typing. Key words (RUN, PRINT, LIST, etc.) have their own single-key entry.**
- Unique syntax check. Only lines with correct syntax are accepted into programs. A cursor identifies errors immediately. This prevents entry of long and complicated programs with faults only discovered when you try to run them.
- Excellent string-handling capability — takes up to 26 string variables of any length. All strings can undergo all relational tests (e.g. comparison). The MicroAce also has string input — to request a line of text when necessary. Strings do not need to be dimensioned.
- Up to 26 single dimension arrays.
- FOR/NEXT loops nested up 26.
- Variable names of any length.
- BASIC language also handles full Boolean arithmetic, conditional expressions, etc.
- Exceptionally powerful edit facilities, allows modification of existing program lines.
- Randomise function, useful for games and secret codes, as well as more serious applications
- Timer under program control.
- PEEK and POKE enable entry of machine code instructions, USR causes jump to a user's machine language sub-routine.
- High-resolution graphics with 22 standard graphic symbols.
- All characters printable in reverse under program control.
- Lines of unlimited length.

'Excellent value' indeed!

For just $149.00 (excluding handling charge) you get everything you need to build a personal computer at home... PCB, with IC sockets for all ICs; case; leads for direct connection to a cassette recorder and television (black and white or color); everything!

Yet the MicroAce really is a complete, powerful, full-facility computer, matching or surpassing other personal computers at several times the price.

The MicroAce is programmed in BASIC, and you can use it to do quite literally anything, from playing chess to managing a business.

The MicroAce is pleasantly straightforward to assemble, using a fine-tipped soldering iron. It immediately proves what a good job you've done: connect it to your TV ... link it to the mains adaptor ... and you're ready to go.

Fewer chips, compact design, volume production-more power per Dollar!

The MicroAce owes its remarkable low price to its remarkable design: the whole system is packed on to fewer, newer, more powerful and advanced LSI chips. A single SUPER ROM, for instance, contains the BASIC interpreter, the character set, operating system, and monitor. And the MicroAce 1K byte RAM (expandable to 2K on board) is roughly equivalent to 4K bytes in a conventional computer — typically storing 100 lines of BASIC. (Key words occupy only a single byte.)

The display shows 32 characters by 24 lines.

And Benchmark tests show that the MicroAce is faster than all other personal computers.

No other personal computer offers this unique combination of high capability and low price.

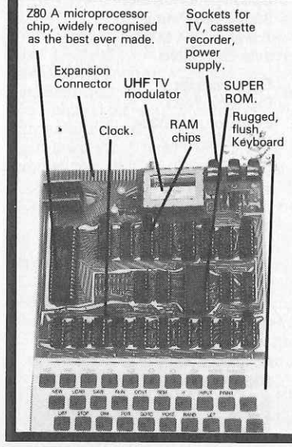
The MicroAce teach-yourself BASIC manual.

If the features of the BASIC interpreter mean little to you-don't worry. They're all explained in the specially-written book *free* with every kit! The book makes learning easy, exciting and enjoyable, and represents a complete course in BASIC programming-from first principles to complex programs. (Available separately-purchase price refunded if you buy a MicroAce later.)

A hardware manual is also included with every kit.

The MicroAce Kit: $149.00 with IK COMPLETE $169.00 with 2K

Demand for the MicroAce is very high: use the coupon to order today for the earliest possible delivery. All orders will be despatched in strict rotation. If you are unsuccessful in constructing your kit, we will repair it for a fee of $20.00, post and packing FREE. Of course, you may return your MicroAce as received within 14 days for a full refund. We want you to be satisfied beyond all doubt — and we have no doubt that you will be.



Your MicroAce kit contains...

- Printed circuit board, with IC sockets for all ICs.
- Complete components set, including all ICs-all manufactured by selected world-leading suppliers.
- New rugged keyboard, touch-sensitive, wipe-clean.
- Ready-moulded case.
- Leads and plugs for connection to domestic TV and cassette recorder. (Programs can be SAVEd and LOADed on to a portable cassette recorder.)
- Mains adaptor of 600 mA at 9VDC nominal unregulated.
- FREE course in BASIC programming and user manual.

JOIN THE REVOLUTION - DON'T GET LEFT BEHIND - ORDER YOUR MICRO ACE NOW!!

Send Check, Money Order or quote your Credit Card No. to:
MicroAce 1348 East Edinger, Santa Ana, California, Zip Code 92705.
or phone (714) 547 2526 quoting your Credit Card Number.

Quantity	Description	Unit Price	TOTAL
	MicroAce Kit 1K	$149.00	
	MicroAce Kit 2K	$169.00	
	Manual	$10.00	
	1K Upgrade Kit	$29.00	
Shipments inside California add 6% TAX		**TOTAL**	

☐ Amex.
☐ Diners
☐ Check
☐ Money Order
☐ Master Charge
☐ Visa

Card No. _____

Exp. Date _____

Name _____

Address _____

City _____ State _____ Zip _____

CIRCLE NO. 42 ON FREE INFORMATION CARD

Even after 100 plays your records will sound BETTER THAN NEW with Lifesaver!

Introducing LIFESAVER™ with DiscProtec™ formula, the multi-purpose record treatment from Audio-Technica. It's a long-term antistatic agent which lasts 100 plays or more. And a record preservative which protects against environmental attack and improves the effectiveness of any wet or dry record cleaner.

But LIFESAVER is also a dry lubricant which sharply reduces record-stylus friction. Tests* prove lower harmonic distortion from a disc treated with LIFESAVER after 100 plays than from the first play of an identical untreated record!

Your records will sound cleaner and quieter from the very first play with LIFESAVER. And 50 or even 100 plays later they'll still sound better than new. Just one easy application protects your library for years.

Enjoy better sound today and tomorrow with LIFESAVER! See dramatic proof at your Audio-Technica dealer today. Audio-Technica U.S., Inc., 1221 Commerce Drive, Stow, Ohio 44224. Dept. 100P. In Canada: Audio Specialists, Inc., Montreal, P.Q.

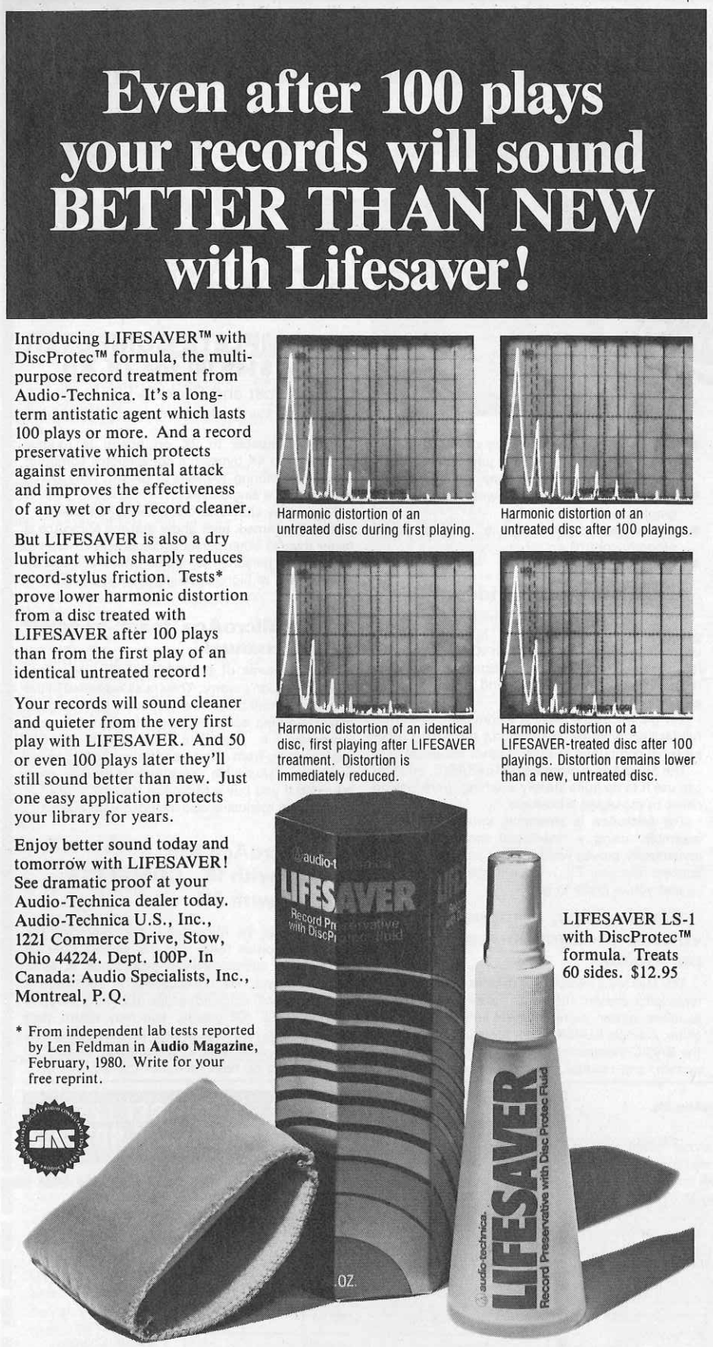
* From independent lab tests reported by Len Feldman in **Audio Magazine**, February, 1980. Write for your free reprint.

Harmonic distortion of an untreated disc during first playing.

Harmonic distortion of an untreated disc after 100 playings.

Harmonic distortion of an identical disc, first playing after LIFESAVER treatment. Distortion is immediately reduced.

Harmonic distortion of a LIFESAVER-treated disc after 100 playings. Distortion remains lower than a new, untreated disc.



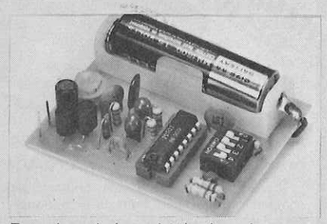
LIFESAVER LS-1 with DiscProtec™ formula. Treats 60 sides. $12.95

audio-technica.
INNOVATION □ PRECISION □ INTEGRITY

AUDIO-TECHNICA PROFESSIONAL AND HOME PRODUCTS FOR BETTER SOUND

want to make for your little girl; or, if you're really inventive, a special function alarm or audible reminder in the darkroom.

If you live in Illinois and like dealing with a timesharing computer system, do the following three things: First purchase your favorite micro system. Then contact Universal Data Systems and order a model UDS 103 LP data Modem. This is a 300-bps, full-duplex unit for $195 that's designed to connect directly to the tele-



Epson's melody evaluation board provides a choice of four tunes.

phone. Once you have everything together, wait until the first Friday of the month. Then, in Illinois, dial 312-726-8260 and watch the screen of your system respond with the lobby of the Gamemaster's house.

The Gamemaster is a unique communication system with a number of games, mail, technical data and so on. Basically, the system has a $50 sign-up fee and costs about $2.75/hr connect time. If you want more information, either wait for the free time from 10 a.m. to 10 p.m. on the first Friday of the month or contact them on the 24-hour hotline. ◇

MORE INFORMATION

For additional information about products mentioned, contact the companies directly.

Asent Computer Services
RR 3
Columbia City, IN 46725
219-625-3600

Epson America Inc.
23844 Hawthorne
Torrance, CA 90505
213-378-2220

Gamemaster
P.O. Box 1483
Evanston, IL 60204
312-236-7522

Okidata Corp.
111 Gaither Dr.
Mt. Laurel, NJ 08054
609-235-2600

Radio Shack
1400 One Tandy Center
Fort Worth, TX 76102

Universal Data Systems
4000 Bradford Dr.
Huntsville, AL 35805
205-837-8100

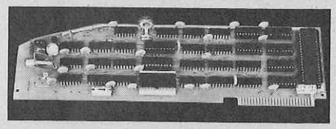
Computer Sources

By Leslie Solomon
Senior Technical Editor

Hardware

TRS-80 Memory Expansion. The MT-32 Printer/Memory expansion module for the TRS-80 will add 16 or 32K of RAM to a basic 16K machine. The module also drives a Microtek MT-80P dot-matrix or any Centronics-compatible printer. No hardware modification is required, simply plug it in the TRS-80 bus connector. Without RAM, MT-32K kit is $79.50; MT-32A assembled is $99.50; MT-32B, with 16K of RAM, assembled is $159.50; and MT-32C, with 32K of RAM, assembled is $199.50. Address: Microtek Inc., 9514 Chesapeake Drive, San Diego, CA 92123 (Tel: 714-278-0633).

80-Column Apple Board. The Sup'R'Terminal from M&R Enterprises plugs directly into an Apple II



and provides 80 columns by 24 lines, upper and lower case on a 5 × 8 dot matrix. Connection to the video monitor is via an on-board jack. The 2K of firmware includes upper/lower case shift, cursor movement, cursor and scrolling modes, clearing and linefeed functions, variable scrolling window, and character definition. The user can define his own characters and switch back and forth among up to 10 different character sets including different alphabets, scientific notation, graphic symbols, etc. These user-defined characters can be printed with a user-programmable dot matrix printer. $395. Contact your local Apple dealer.

AIM Programmer/Editor. The CO-ED A65-901 module features a PROM programmer and code editor in a single plug-in for the AIM-65 and SYSTEM-65 machines. The module provides PROM check, read, and verify in addition to programming. Data load, verify, and dump, each with offset, and an object code editor are additional features. The latter controls the editor program pointer and can search, disassemble, and modify R6500 object-code programs. The module includes 1K byte of RAM, which, when used with the 4K RAM AIM-65, allows single-pass programming of 4K × 8 PROMs. It includes logic to select 2758, 2716, 2732, TMS 2508, 2516, or 2532 PROMs without switch or jumper changes. $265. Address: Electronic Devices Div., Rockwell Intl., Box 3669, Anaheim, CA 92803 (Tel: 714-632-3729).

Atari Expansion. This new kit enlarges any Atari 8K RAM board to 16K to provide more space for high-resolution (GR 7) graphics and allows

access to higher-resolution (GR 8) 320 × 192 graphics. $79.95. Address: Mosaic Electronics, Box 748, Oregon City, OR 97045.

British S-100. The Tuscan S-100 is a Z80-based computer using the IEEE standard S-100 bus. Five S-100 cards can be plugged into the bus. The Tuscan has powerful I/O capabilities and is ready for immediate expansion. Both BASIC and PASCAL are available. Address: Transam, 12 Chapel St., London, NW1 5DH, England.

Apple NTSC. The Adwar Apple Proc Mod device is a plug-in circuit board which converts the nonstandard Apple video output into a format sufficiently close to NTSC standards to permit using a conventional video tape recorder. $800. Address: Adwar Video, 100 Fifth Ave., New York, NY 10011 (Tel: 212–691–0976).

Six Monitors on One Printer. The PC-1 Printer Controller provides means to hard copy the output of up to six CRT monitors on one printer. The PC-1 connects to any RS-232 printer and contains six channels that remain operative even if one or more of the monitors is down or off. A pushbutton allows the operator of any terminal to access the printer. When printing is finished, another

OUR PRICES ARE TOO LOW TO ADVERTISE!
CHECK THEM—CALL TOLL FREE!
800-243-7428
LOOK WHAT WE OFFER!

- HAZELTINE Terminals
- CENTRONICS Printers
- LEAR-SIEGLER Terminals/Printers
- DATAPRODUCTS Printers
- ANNADEX Printers

BE SMART-DON'T BUY UNTIL YOU CHECK OUR PRICES!

___ MASTERCHARGE
___ VISA ___ COD
___ PERSONAL CHECK
___ MONEY ORDER

NETRONICS
RESEARCH & DEVELOPMENT, LTD.
333 Litchfield Rd., New Milford, CT 06776